TACOM

Mobility and Firepower
for America's Army

Vetronics Reference Architecture

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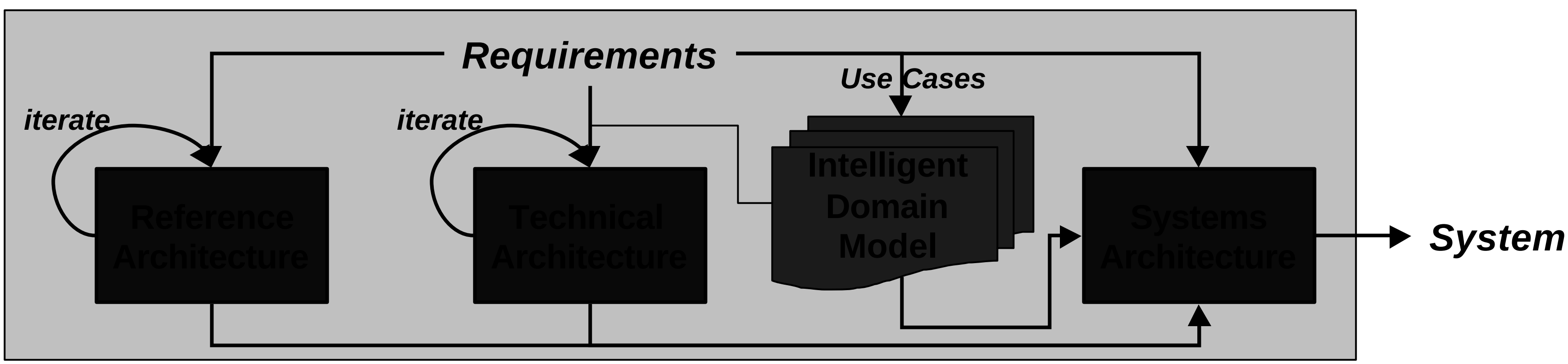
Agenda

- Architecture Concepts/Overview
- VRA Objectives
- VRA Components
- Systems Reference Architecture
- Hardware Reference Architecture
- Software Reference Architecture

Architecture Concepts/Overview

- Reference Architecture (RA)
  - Abstract view/organization of primary elements within the domain.
  - Serves as specific System Architecture development framework.
- Technical Architecture (TA)
  - Standards (hw, sw, mechanical, etc.) utilized as building blocks to construct systems.
- Intelligent Domain Model
  - Captures system intelligence such that computational processes can be allocated to system processing components (e.g. human, robotic, man in the loop)
- Systems Architecture (Cross product of RA, TA, and Intelligent Domain Model)
  - Defines interconnected systems components organized to represent the final manner in which the system will be constructed to include hw and sw.



Need to focus on refining RA, TA, and Intelligent Domain Model to derive a common Vetronics architecture.

VRA Objectives

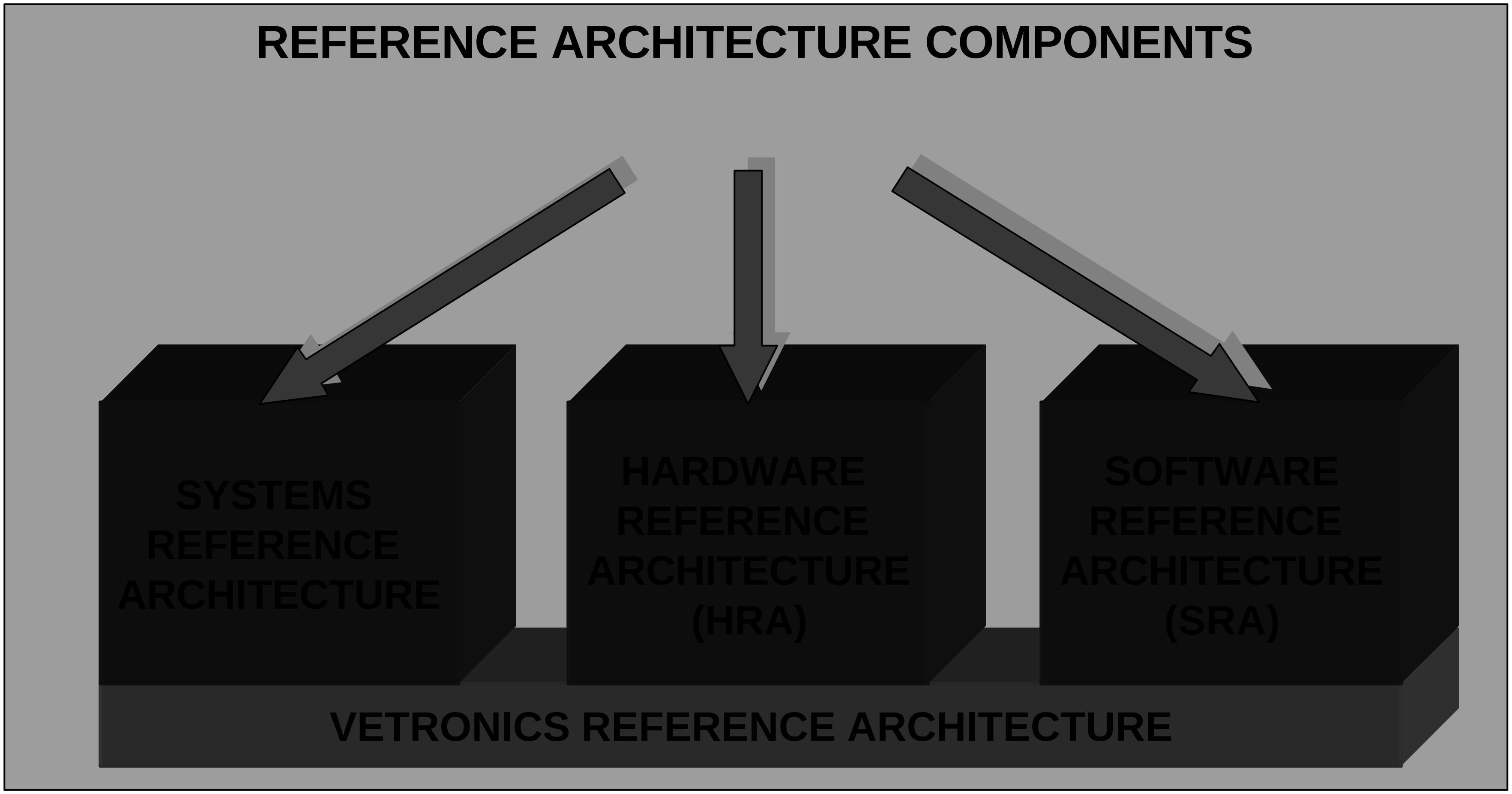
- The main objective of the VRA is to define a generic system architecture that can serve as a template for the development of new or upgraded Vetronics & Robotic systems

  - Reduce ground combat vehicle acquisition and support costs through:
    - ***Improved Commonality***
    - ***Increased Hardware Component Reuse***
    - ***Increased Software Component Reuse***
  - Utilizes Industry Supported Open Standards
  - Provides:
    - ***Fault Tolerance***
    - ***Redundancy***
    - ***Degraded Operation Modes***
  - Facilitates Upgradability through:
    - ***Standard Interfaces***
    - ***Technology Insertion***

The RA maximizes the use of industry supported open standards and promotes software reuse

Vetronics Reference Architecture Components

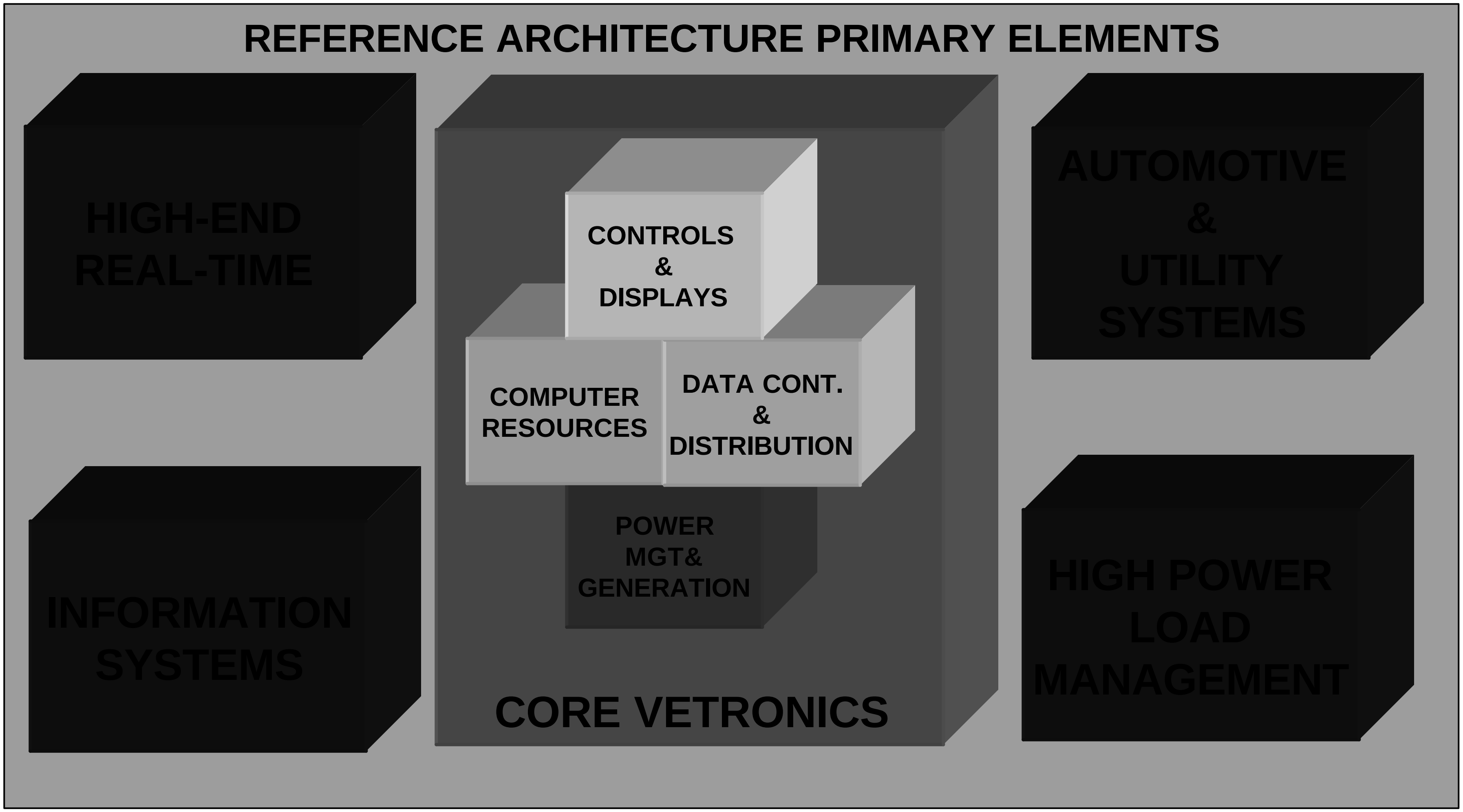
- The Vetronics Reference Architecture is characterized by three components:



The Reference Architecture (RA) components are partitioned by engineering discipline

System Architecture Elements

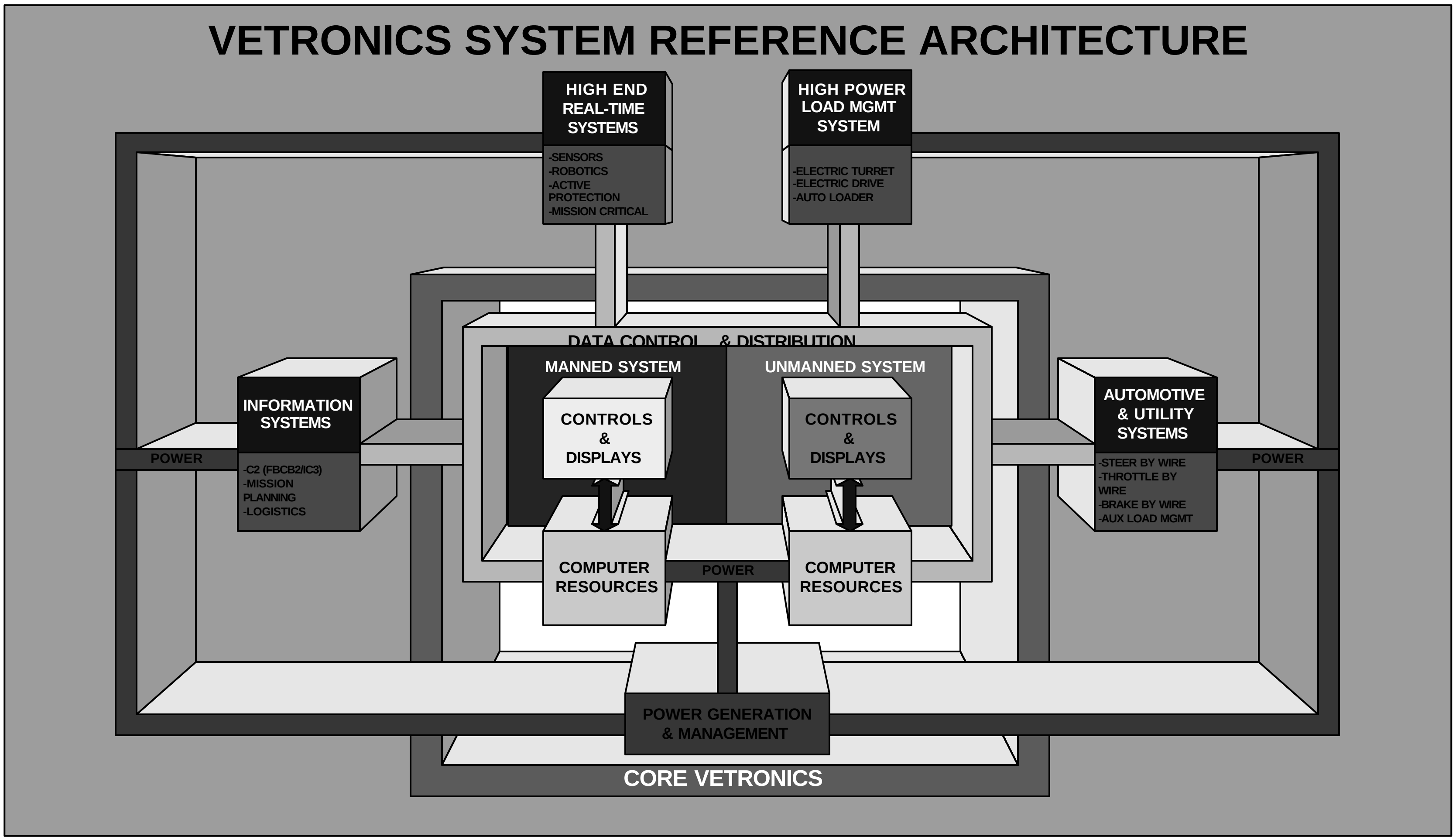
- The Army ground vehicle manned/robotic system will be divide into five primary elements:



The Primary Elements provide the bins for leveraged industry & government technologies

System Reference Architecture

- The System Reference Architecture defines the abstract organization of the primary elements within the system



The System Reference Architecture is for both manned and unmanned systems

System Reference Architecture Standards

- High Speed Data Bus
- For vehicle applications requiring a high-speed (~1 Gbps) data transfer capability between Core Vetronics and other vehicle systems:
  - Example Standards – ***ANSI X3.230, Fibre Channel, Physical and Signaling Interface***

    ANSI X3.272, Fibre Channel, Arbitrated Loop

    IETF Standard 6, User Datagram Protocol

Test, Debug, and Maintenance Bus

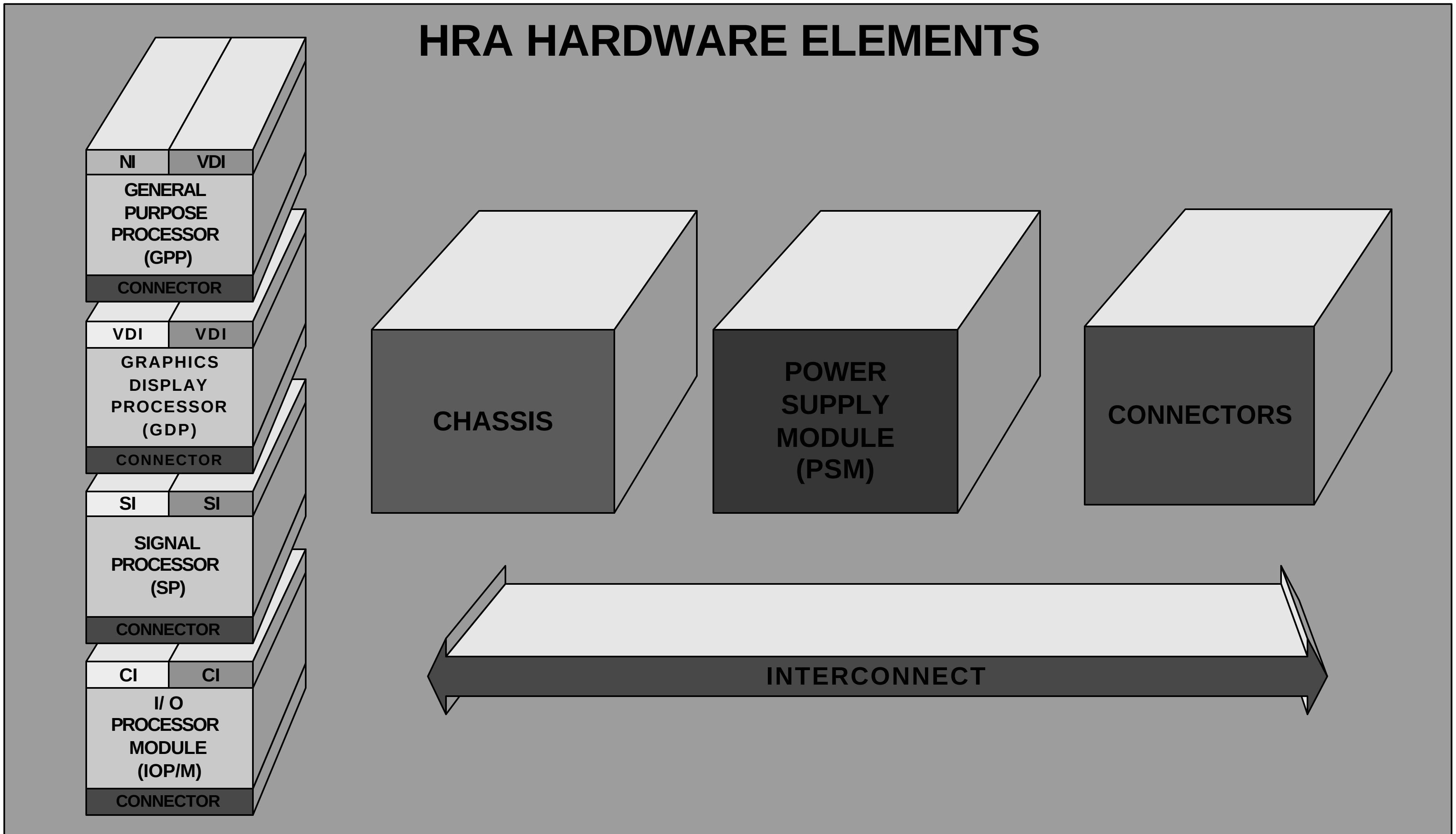
- For digital data communications to processing elements within a vehicle for the purpose of test, debug, and maintenance:
  - Example Standards – ***IETF Standard 5, Internet Protocol***

    IETF Standard 7, Transmission Control Protocol

Complete listing of the standards is in the VRA document

Hardware Reference Architecture

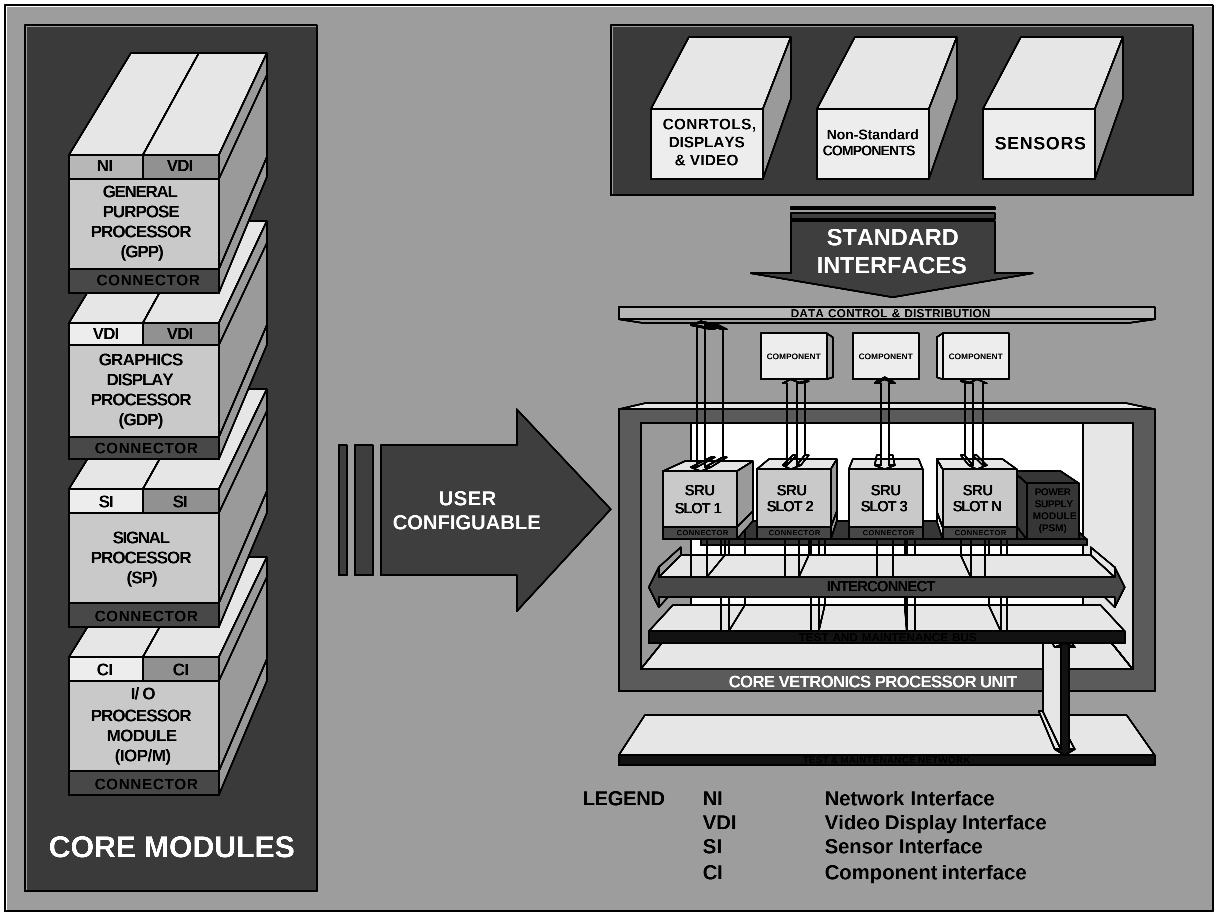
- The Hardware Reference Architecture consists of the following of user configurable elements:



The HRA hardware is an open, expandable architecture that is scalable to meet application requirements and target unit cost

Hardware Reference Architecture Cont.

- The HRA open architecture utilizes and supports the use of industry open standards thus providing a means to promote:
  - ***Commonality, Reusability and Upgradeabiliy***



Depending on the crew size, complexity and fault-tolerance requirements of the vehicle one or more physical nodes may be required.

Hardware Reference Architecture Standards

- CVPU Chassis consists of a a backplane that mechanically accept circuit cards.
  - ***Utilize conduction cooling as a preferred means of removing heat***
  - Example Standards – ***ANSI/VITA 1 (VME64)***
    IEEE Std 1101.2 (Conduction-Cooled Eurocards)

- SRU modules accommodate mezzanine plug-on card sites for application tailoring and I/O expansion and custom interfaces
  - ***Utilize PMC as a preferred interface***
  - Example Standards – ***PICMG Version 2.1 Compact PCI (Peripheral Component Interconnect) Specification***
    IEEE P1386.1 (PCI Mezzanine Cards)

- Power Supply Module (PSM) - will provide all the necessary power for components in the CVPU.
  - ***Utilize military standards for vehicle power requirements***
  - Example Standards -***MIL-STD-1275***
    MIL-STD-464

Complete listing of the standards is in the VRA document

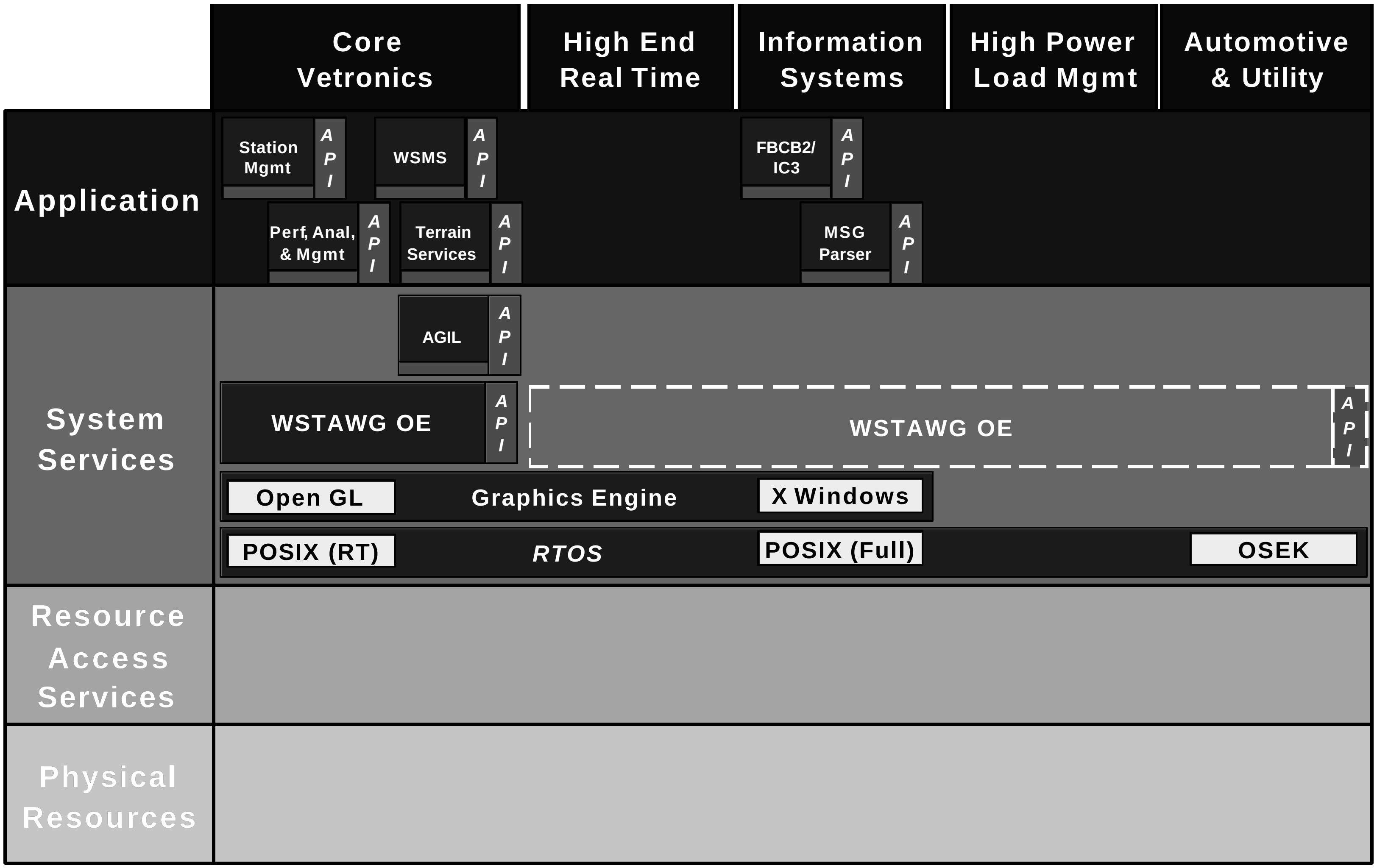
Software Reference Architecture Rationale

- Identification, selection, and application of relevant standards/middleware.
- Ensuring mixed software languages, middleware, and development environments work together.
- Selection/integration of relevant next generation technologies while avoiding technology obsolescence.
- Maximization of COTS technologies/products (promote multiple vendor sources/competition to ensure availability of market alternatives).
- Maintaining real time performance while providing protection/isolation to the application software.
- Reduce the amount of time required to develop Vetronics systems
- Keep us on schedule and budget
- Produce re-useable Vetronics hardware and software components
- Increase the level of commonality between vehicles
- Promote the adoption of open systems architecture concepts
- Improve compliance with JTA-Army standards

Software Reference Architecture Goals

- Non proprietary and Open System
- Provide flexibility where possible
- Layered and focused on interfaces
  - Provide traceability from APIs to defined system requirements.
  - Design APIs for reuse and interoperability (define physical/logical interfaces).
    - Define APIs/middleware to isolate dependencies, ease porting,
    - Define APIs/middleware to be adaptable in order to map to a variety of implementations.
  - Define APIs/middleware such that they can be replaced by emerging standards as they mature and are accepted by industry and DoD.
  - Design APIs for testability (carry through conformance/validation requirements).
- Not locked into specific paradigms (e.g. patterns, languages, methodologies).
- Include industry, academia, and standards bodies to the degree possible when defining new APIs and/or middleware.

Software Reference Architecture



Populated from JTA-Army and Iterative TA and Domain Intelligence Modeling.

API/Standards-Based Software Reference Architecture

- An API/Standards-based architecture concentrates on interface definition by identifying applicable APIs and standards for physical and logical interfaces.
  - Utilizes SAE GOA model as a clear concise framework to partition capability.
  - Concentrates on interfaces to achieve interoperability, not products.
- Benefits:
  - Promotes reuse at multiple layers.
  - Minimizes application impact from insertion of new technologies.
  - Facilitates interoperability through the identification of unambiguous interface definitions.
  - Enables plug and play capability not only at the resource access services layer (hw/drivers), but at the system services and application layers as well.
- Where Utilized:
  - Commercial/industrial base to facilitate product line engineering.
  - WSTAWG/JTA-Army

Summary

- VRA defines a generic system architecture that can serve as a template for the development of new or upgraded Vetronics & Robotic systems
- VRA consists of a system, hardware and software reference architecture
- The VRA
  - Reduces ground combat vehicle acquisition and support costs
  - Utilizes Industry Supported Open Standards
  - Facilitates Upgradability
- The VRA is being used on the Crew-Automation and Integration Testbed/Robotic Follower Advanced Technology Demonstrator

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